

# Signal Classification and Transforms

You said:



give the tables for signals and classify them into periodic causal etc and their fourier and laplace transform

ChatGPT said:



Sure! Let's break down signals into categories based on their properties (periodic, causal, etc.) and provide their Fourier and Laplace transforms.

## 1. Classification of Signals

Signal	Type	Definition	Example
<b>Sinusoidal Signal</b>	Periodic, Deterministic	A signal that repeats after a certain period.	$x(t) = \sin(\omega t)$
<b>Exponential Decay</b>	Aperiodic, Deterministic	A signal that decays exponentially and doesn't repeat.	$x(t) = e^{-\alpha t}$
<b>Unit Step (<math>u(t)</math>)</b>	Aperiodic, Causal	A signal that is zero for $t < 0$ and one for $t \geq 0$ .	$u(t) = \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases}$
<b>Unit Impulse (<math>\delta(t)</math>)</b>	Aperiodic, Causal	A signal that is zero everywhere except at $t = 0$ , where it is infinite.	$\delta(t)$
<b>Ramp Signal (<math>r(t)</math>)</b>	Aperiodic, Causal	A signal that increases linearly with time for $t \geq 0$ .	$r(t) = t \cdot u(t)$

## 2. Fourier and Laplace Transforms

Signal	Fourier Transform	Laplace Transform
<b>Sinusoidal Signal</b>	$x(t) = \sin(\omega t)$	$\mathcal{F}\{x(t)\} = \frac{j}{2}[\delta(\omega - \omega_0) - \delta(\omega + \omega_0)]$
<b>Exponential Decay</b>	$x(t) = e^{-\alpha t}u(t)$	$\mathcal{F}\{x(t)\} = \frac{1}{j\omega + \alpha}$
<b>Unit Step (<math>u(t)</math>)</b>	$x(t) = u(t)$	$\mathcal{F}\{x(t)\} = \frac{1}{j\omega} + \pi\delta(\omega)$
<b>Unit Impulse (<math>\delta(t)</math>)</b>	$x(t) = \delta(t)$	$\mathcal{F}\{x(t)\} = 1$
<b>Ramp Signal (<math>r(t)</math>)</b>	$x(t) = t \cdot u(t)$	$\mathcal{F}\{x(t)\} = \frac{-1}{(j\omega)^2}$

## 3. Further Classifications

- Periodic Signals:** Repeat after a fixed time period  $T$ .
- Aperiodic Signals:** Do not repeat periodically.

- **Causal Signals:** Are zero for  $t < 0$ .
- **Non-causal Signals:** Have non-zero values before  $t = 0$ .

If you need additional details or have any specific signals you want to explore, let me know!

You said:



test whether the signal  $(t) = e^{-5t}$  is even or odd.

ChatGPT said:



To determine if the signal  $x(t) = e^{-5t}$  is even or odd, we need to use the definitions of even and odd functions:

- **Even Function:**  $x(t)$  is even if  $x(-t) = x(t)$ .
- **Odd Function:**  $x(t)$  is odd if  $x(-t) = -x(t)$ .

Let's check both conditions for  $x(t) = e^{-5t}$ .

1. **Check if  $x(t)$  is even:**

$$x(-t) = e^{-5(-t)} = e^{5t}$$

Since  $e^{5t} \neq e^{-5t}$ , the function is not even.

2. **Check if  $x(t)$  is odd:**

$$-x(t) = -e^{-5t}$$

Since  $x(-t) = e^{5t} \neq -e^{-5t}$ , the function is not odd.

Therefore, the signal  $x(t) = e^{-5t}$  is neither even nor odd.

ChatGPT can make mistakes. Check important info.